China-Ghana South-South Cooperation on Renewable Energy Technology Transfer (RETT)

Identification of barriers to renewable energy technology transfer to Ghana

Coordinated by:

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Stakeholder consultation workshop
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Empowered lives.
Resilient nations.

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Presentation in two parts:

1. History, Current and Future Trends of RETT in Ghana

2. Success stories of RETT Globally

HISTORY, CURRENT AND FUTURE TRENDS OF RETT IN GHANA

Outline

- Introduction
- Solar PV (stand-alone and grid-connected) and Solar Lanterns
- Biogas
- Other bioenergy types
- Improved cookstoves
- Wind and mini-hydro
- Renewable Energy Training Activities
- Future of RETTs in Ghana

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Introduction

- In principle, Ghana has been the home of RE development from the very beginning of electricity technology development.
  - Akosombo hydropower plant – first major electricity plant
  - Kpong hydropower plant – second major electricity plant

- A lot followed …may not have been intended as pure technology transfer projects, but by their nature, were technology transfer related.
- Ghanaians have learnt to accept these technologies, embrace them, and adapt to them as the years have gone by.

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Solar PV (stand-alone and grid-connected) and Solar Lanterns

- Solar systems were first introduced to Ghana for Lighting.
- With innovation and a little technology transfer, we now have systems for:
  - Entertainment
  - Vaccine refrigeration
  - Streetlight systems;
  - Water pumping systems
  - Solar battery charging
  - Systems for communication
  - Centralized grid-connected systems and solar water heating systems.

Solar PV projects with TT components

- *Lighting Africa (2009-2012)*
  - Provision of advisory services to government, ***manufacturers*** **and** ***suppliers***;
  - ***Training*** selected ***manufacturers*** and *distributors* on funding opportunities, distribution models and business management; and
  - ***Training technicians*** to provide after sales services and maintenance.
- *Affordable Lighting for All (2007-2012)*
  - ***Training activities*** were carried out for the local actors and a ***training manual*** was developed in this regard.
- *Government's 200,000 solar lanterns project (2012-2016)*
  - 200,000 solar lanterns in off-grid rural homes over a period of five years
  - Phase two would support the establishment of ***local assembly of solar lanterns***

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Other solar energy related projects

- Solar dryers – experimental schemes and piloting of commercial scale sizes (AESD – Mr Johnson Panni; and The Energy Center - KNUST)
- Other solar thermal systems: solar water heaters market driven (Kof. Poly active in experimental systems)

Biogas

- About four decades of biogas technology dissemination in Ghana – very slow in deployment
- Appolonia project, commissioned in 1992, was supposed to be the beginning of a vigorous campaign to promote biogas technology in Ghana; plants were constructed by experts from the Energy Ministry and the Institute of Industrial Research (IIR) of the CSIR, with support from China.
- More experts trained …
- Catholic Secretariat and GTZ also became involved in the dissemination of biogas technology in Ghana.

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Biogas

- The Appolonia project faced a number of challenges, which slowed down government interest in biogas technology
- Major challenges facing biogas plants in Ghana include:
  - Poor level of construction;
  - Lack of skilled attendants; and
  - Poor maintenance
- Chinese fixed dome type and Indian floating drum type common in the past – *more modern designs springing up*
- Lighting applications being implemented with new projects

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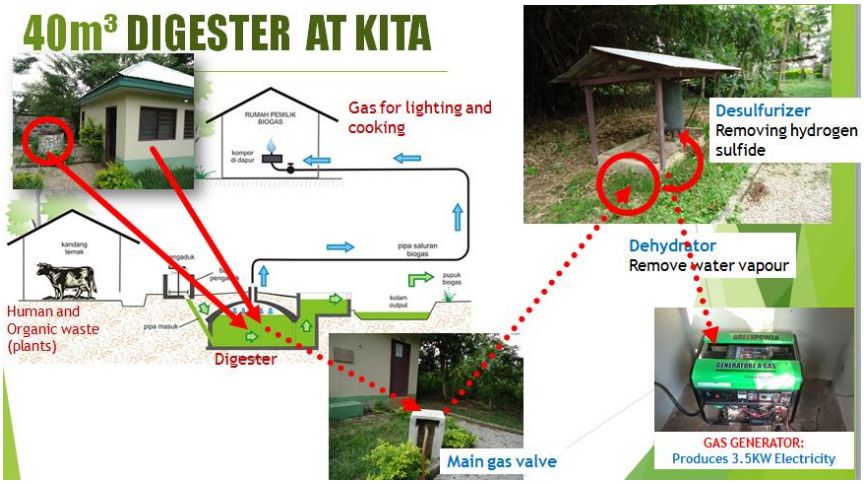
Biogas



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Other bioenergy types

- Pellets manufacturing ongoing in Kumasi – *250 tonnes per day plant*
- Briquette feasible – *earlier start-up failed due to poor business model*
- Liquid biofuels – *failed largely due to poor support*
- Second generation biofuels only at research stage – *but then, first generation never really took off. Appears to be led by academic curiosity*

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Improved Cookstoves

- Perhaps the technology to have benefited most from technology transfer
- Ahibenso was promoted with a lot of training activities though it never really gelled!
- Ahibenso failed for several reasons, a key reason being: *poor quality of the stoves produced by trained artisans which failed to match aesthetically the ones shown on television*
- In 2002 EnterpriseWorks/Vita introduced Gyapa, a variant of Jiko from Kenya; transferred the technology to Ghana by equipping artisans with the skill to locally fabricate the stove.

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Improved Cookstoves: The Gyapa revolution

- Two *training sessions* were held for 78 artisans and technologist in Accra and Kumasi on the *design and fabrication* of the improved coosktoves
- Companies sprung up afterwards; networks of manufacturers across country
- Gyapa has enjoyed better success and has gone through a few modifications using ***indigenous knowledge***
- Many local institutional stoves built and in use
- Testing facilities built
- Enjoys wider stakeholder support

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Wind and Mini-hydro

- No commercial wind power project as at 2015
- Activities in the wind energy sector have so far been limited to resource assessment, where several studies have taken place, led by the Energy Commission.
- Presence of new companies - Ghana Wind Power Ltd (GhaWiPo) and NEK (Ghana)
- The Volta River Authority (VRA) has also commenced activities in the sector.
- Like wind, very little has been done with regards to mini-hydro

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Renewable Energy Training Activities

- PhD and MSc Renewable Energy Technology – KNUST
- BSc Renewable Energy Technology – UENR
- HND Renewable Energy Technology – Kof. Poly
- Short courses – KNUST, Wilkins, etc.
- Curriculums under development for other institutions
- Next level – SHS Certificate???




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The Future of RETT in Ghana

- About 500MW target for RE electricity by 2020 depending on wheeling capability
  - RETT has a lot to play in achieving this
- Cookstove development laudable
  - Wind and mini-hydro has a long way to go
- Adopting RETT would likely lead to
  - cost reduction
  - opportunities for local manufacture can have several positive impacts.
- China is a 'superpower' in RE infrastructure and Ghana would benefit immensely from current project if implemented well

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SUCCESS STORIES OF RETT GLOBALLY

A lot of success stories!

- South Africa: National SWH programme – Eskom rebate scheme
- Zimbabwe – Building SWH for local conditions
- Southern African Solar Thermal Training and Demonstration Initiative (Soltrain)
- Solar lighting: China-Kenya solid state solar TT centre
- Algeria: Hassi R'mel Integrated Solar Combined-Cycle (ISCC)
- Kenya: a story of TT in institutional cookstoves
- Rwanda: Inyenyeri micro-gasification pellet stove programme
- African biogas partnership programme (ABPP)
- Concentrated Solar Power in India

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Morocco a shining example!

World's Largest Solar Plant to

MENAFN - Qatar News Agency - 24/11/2015

No. of Ratings : 0

(MENAFN - Qatar
solar plant using
Moroccan city at n

The giant solar
harness the Sun's
its heat to generat

The first phase
dark; the last stage aims to supply power 20 hours a

It is part of Morocco's pledge to get 42% of its electr

The Saudi-built Ouarzazate solar thermal plant will
mirrors will cover the same area as the country's capi

Paddy Padmanathan of Saudi-owned ACWA Power,

The mirrors at the plant at Ouarzazate cover the same area as the

Moroccan solar plant to bring energy to a million people

By Roger Harrabin
BBC environment analyst

23 November 2015 | Science & Environment

Rows of curved mirrors capture solar energy

A giant plant using energy from the Sun to power a Moroccan city at night will open next month.

The solar thermal plant at Ouarzazate will harness the Sun's warmth to melt salt, which will hold its heat to power a steam turbine in the evening.

The first phase will generate for three hours after dark; the last stage aims to supply power 20 hours a day.

Solar thermal: case study of solar water heater (SWH) TT programmes

- South Africa and Tunisia have highest penetration in Africa
  - Supported by favourable policies and regulatory frameworks
- South Africa has target of 5 million SWH by 2020 but implementation has been slow due to a few barriers:
  - Delays in testing equipment for approval
  - Distrust in equipment
  - Faulty installations
  - High initial cost
  - Cheaper 'electricity' alternative
- Lessons being tackled
  - Higher manufacturing of components

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Zimbabwe partnership with Austria on SWH

- Zimbabwe cooperating with Austria to develop SWH suitable for local conditions
- In a move to create market for the sector, Zimbabwe is making '*plans to introduce regulations banning the importation and use of electric water heaters, while mandating all new structures to incorporate SWH*'.
- This initiative if implemented is expected to save between 300-400 MW
- Roadmap designed for the realisation of this ambitious policy direction involves the building of capacity of local companies in the manufacture of SWH.

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Kenya: a success story of TT in institutional cookstoves

- Background
  - Four year programme, Market Transformation for Efficient Biomass Stoves for Institutions and Small and Medium-Scale Enterprises (MTES), under GEF, targeting cookstove dissemination in institutions and small businesses from 2007-2010
- Aim
  - Remove market barriers to the adoption of modern biomass energy practices and clean cookstoves by institutions and small businesses.
- Improved institutional wood stoves were fabricated and supplied mainly by a local company, Rural Technology Enterprises (RTE) that has supported cookstove initiatives since 1984.

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Kenya: a success story of TT in institutional cookstoves

- The programme also had components related to the cultivation of fast-growing energy crops such as some varieties of eucalyptus in woodlots to specifically provide wood for institutional kitchens
- Outputs and outcomes
  - Over 2000 well-engineered and locally manufactured stoves were distributed to schools, restaurants, hotels and households. As at 2008, about 10-15% of educational institutions were using improved institutional cookstoves in Kenya.
  - Project led to the cultivation of over 600 thousand trees in about 34 hectares of plantations.
- Barriers and lessons
  - Lack of follow-up and monitoring on the establishment of the woodlots which appeared to be the least successful.
  - Another challenge encountered include irregular supply of materials such as stainless steel for stove fabrication, high cost of stoves, sustaining funding for the programme and data collection.

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Other success stories

- **African biogas partnership programme (ABPP) targeted 70,000 installations**
  - In ***Burkina Faso***, the first phase led to installation of a little over 4000 digesters from 2009-2013, representing 67% of target installations. The number of installations was about 5,500 by end of 2014.
  - In ***Ethiopia***, Nearly 10,000 plants were constructed by end of 2014
  - In ***Kenya***, more than 550 masons were trained, leading to the creation of 82 registered companies and 240 registered sole proprietors
  - The programme led to the dissemination of about 5000 plants from 2009-2013 in ***Uganda***.
  - In ***Tanzania***, the programme adopted a modified CAMARTEC digester. By 2011 about 2500 digesters for mainly rural cattle (or pigs and other farm animals) households have been installed.

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Key success factors

- Local manufacturing capacity
- '***Hard-line***' policies: e.g. strict building efficiency codes and banning of conventional systems
- Building on niches
- Taking advantage of opportunities and (sometimes) unfortunate situations
- Massive awareness campaigns

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Thank you for your attention

Questions/comments/suggestions